

**REMARKS**

Claims 1-8, 16-28, and 37 are pending. Claim 1, 16, 22, and 37 are in independent form.

***Rejections under 35 U.S.C. § 103***

In the action mailed May 16, 2007, claim 1 was rejected under 35 U.S.C. § 103(a)<sup>1</sup> as obvious over U.S. Patent No. 4,517,280 to Okamoto et al. (hereinafter "Okamoto") and U.S. Patent Publication No. 2003/0091940 to Nakao (hereinafter "Nakao")

Claim 1 relates to a method that includes patterning a substrate with a substantially arbitrary arrangement of features. The patterning includes patterning an array of repeating lines and spaces between the lines in a first photoresist layer and introducing irregularity into an area of the substrate covered by the array of repeating lines and spaces. The irregularity is introduced by forming an arbitrary figure in a second photoresist layer above the array.

The arbitrary figure comprises a first feature and a second

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<sup>1</sup> The heading of paragraph 2 on page 2 of the Office action indicates that claims 1-7 and 16-20 are rejected under 35 U.S.C. § 102(b) as anticipated by Okamoto and Nakao. In light of the remainder of paragraph 2, applicant has assumed that this is a typographical informality. If this assumption is in error, applicant respectfully requests that the present response be considered *bona fide*, the basis of the anticipation rejection explained, and an extended period for response be provided.

feature that are noncontiguous and that each bridge one or more of the repeating lines and spaces at different longitudinal positions.

The rejection of claim 1 contends that it would have been obvious for one of ordinary skill to have combined Okamoto and Nakao to arrive at the recited subject matter.

Applicant respectfully disagrees. In this regard, Okamoto's intended purpose is "making a diffraction grating having a desired period and size in a desired location." See, e.g., *Okamoto*, col. 1, line 6-8. According to Okamoto, a diffraction grating is a collection of "periodic ridges and grooves [that] are formed on the substrate." See, e.g., *Okamoto*, col. 1, line 64-66. Okamoto desires to make such a collection of periodic ridges and grooves in a desirable location on a substrate, even if the are covered by the grating is very small. See, e.g., *Okamoto*, col. 2, line 31-34.

Since claim 1 recites that irregularity is introduced into an area of the substrate covered by an array of repeating lines and spaces, claim 1 is inherently incompatible with Okamoto's intended purpose of making diffraction gratings. In particular, if irregularity is introduced into an area of the substrate

covered by an array of repeating lines and spaces, then that area no longer has a collection of periodic ridges and grooves and the gratings desired by Okamoto have been eliminated.

It is well-established that, for a proper rejection under 35 U.S.C. §103(a), a proposed modification of a reference cannot render the reference unsatisfactory for its intended purpose. See, e.g., M.P.E.P § 2143.01 (V.) (entitled "THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE") (citing *In re Gordon*, 733 F.2d 900 (Fed. Cir. 1984)). In the present case, there is no reason to believe that one of ordinary skill would modify Okamoto to depart from Okamoto's intended purpose of making small area diffraction gratings in a desirable locations. Accordingly, the subject matter recited in claim 1 would not have been obvious to those of ordinary skill.

Moreover, even if Okamoto's intended purpose were ignored and Okamoto were combined with Nakao, one of ordinary skill would still not arrive at the subject matter recited in claim 1. For example, nothing in Nakao would lead one of ordinary skill to introduce irregularity into Okamoto's gratings by forming noncontiguous features that each bridge one or more of the repeating lines and spaces of a grating at different longitudinal positions, as recited in claim 1.

In this regard, Nakao is concerned with forming bright line patterns with reduced dispersion of a critical dimension. See, e.g., Nakao, para. [0015]. To achieve this reduced dispersion, Nakao describes that bright line patterns can be formed using exposures of at least four times and but not more than 10 times the exposure for photosensitizing a photosensitive material and "inverting" the solubility thereof. See, e.g., Nakao, para. [0016].

While Nakao describes that such elevated exposures are successful for "fine" bright line patterns, Nakao also describes that such exposures can be excessive for "relatively large" bright line patterns. See, e.g., Nakao, para. [0097]. In particular, the elevated exposure can lead to a deterioration of formability (DOF) for the relatively large bright line patterns. See, e.g., Nakao, para. [0097].

To address this issue, Nakao describes a number of embodiments in which a pair of photomasks is prepared. See, e.g., Nakao, FIGS. 20A, B, C; FIGS. 26A, B, C; FIGS. 35A, B, C. In each case, "fine bright line patterns" are extracted from a desired pattern. See, e.g., Nakao, para. [0098]; para. [0113]; para. [0127]. A first photomask is prepared to expose these "fine bright line patterns" and a second photomask is prepared to expose the remaining (i.e., "relatively large") bright line

patterns. *Id.* The fine bright line patterns are subsequently exposed using the first photomask and exposures of at least four times and but not more than 10 times. *See, e.g., Nakao*, para. [0100]; para. [0115]; para. [0129]. The remaining (i.e., "relatively large") bright line patterns are subsequently exposed using the second photomask and a "general light exposure." *See, e.g., Nakao*, para. [0101]; para. [0121]; para. [0133].

None of the lines in Nakao's fine bright line patterns ever cross the lines in Nakao's remainder (i.e., "relatively large") bright line patterns. Instead, the lines in the Nakao's successive patterns never cross. This is true even of the embodiment shown in FIGS. 35-43 cited in the rejection.

Applicant respectfully submits that nothing in Nakao would lead one of ordinary skill to introduce irregularity into Okamoto's gratings by forming noncontiguous features that each bridge one or more of the repeating lines and spaces of a grating at different longitudinal positions, as recited in claim 1. As discussed above, Nakao uses two masks to avoid excessive exposures associated with "relatively large" bright line patterns. This is not understood to be relevant to the recited

formation of noncontiguous features that bridge one or more of the repeating lines and spaces of a grating at different longitudinal positions.

Moreover, none of Nakao's bright lines bridge one another. Instead, the lines in the Nakao's successive patterns never cross.

Thus, even if Okamoto and Nakao were combined, one of ordinary skill would not arrive at the recited subject matter. Claim 1 is not obvious on this basis as well.

Accordingly, applicant respectfully requests that the rejections of claims 1 and the claims dependent therefrom be withdrawn.

Claim 16 was rejected under 35 U.S.C. § 103(a) as obvious over Okamoto and Nakao.

Claim 16 relates to a method that includes interfering electromagnetic radiation to illuminate a substrate with an interference pattern, and introducing irregularity into an area on the substrate covered by the repeating lines and spaces to impart an arbitrary feature arrangement to the substrate. The interference pattern imparts a first photoresist layer on the substrate with repeating lines and spaces.

Introducing irregularity comprises forming an arbitrary figure in a second photoresist layer above a portion of the repeating lines and spaces. The arbitrary figure comprises a first feature and a second feature that are noncontiguous and that each bridge one or more of the repeating lines and spaces at different longitudinal positions.

The rejection of claim 16 contends that it would have been obvious for one of ordinary skill to have combined Okamoto and Nakao to arrive at the recited subject matter.

Applicant respectfully disagrees. In this regard, as discussed above, Okamoto's intended purpose is making a diffraction grating having a desired period and size in a desired location. Since claim 16 recites that irregularity is introduced into an area of the substrate covered by repeating lines and spaces, claim 16 is inherently incompatible with Okamoto's intended purpose of making diffraction gratings. Accordingly, the subject matter recited in claim 16 would not have been obvious to those of ordinary skill.

Moreover, even if Okamoto's intended purpose were ignored and Okamoto were combined with Nakao, one of ordinary skill would still not arrive at the subject matter recited in claim 16. For example, nothing in Nakao would lead one of ordinary skill to introduce irregularity into Okamoto's gratings by

forming noncontiguous features that each bridge one or more of repeating lines and spaces at different longitudinal positions, as recited in claim 16.

In this regard, as discussed above, Nakao uses two masks to avoid excessive exposures associated with "relatively large" bright line patterns. This is not understood to be relevant to the recited formation of noncontiguous features that bridge one or more of the repeating lines and spaces of a grating at different longitudinal positions. Moreover, none of Nakao's bright lines bridge one another. Instead, the lines in the Nakao's successive patterns never cross.

Thus, even if Okamoto and Nakao were combined, one of ordinary skill would not arrive at the recited subject matter. Claim 16 is not obvious on this basis as well.

Accordingly, applicant respectfully requests that the rejections of claims 16 and the claims dependent therefrom be withdrawn.

Claim 22 was rejected under 35 U.S.C. § 103(a) as obvious over Okamoto, Nakao, and European Patent Application EP 0915384 to Sugita et al. (hereinafter "Sugita").

Claim 22 relates to a method that includes patterning a first layer on substrate using a first lithographic technique, printing, in a photoresist layer using a second lithographic



technique providing a second pitch, a first feature to bridge a first collection of one or more of the repeating lines and spaces at a first longitudinal position, a second feature to bridge a second collection of one or more of the repeating lines and spaces at a second longitudinal position, and a third feature to bridge a third collection of one or more of the repeating lines and spaces at a third longitudinal position, and etching the substrate to transfer, to the substrate, a superposition of the lines and spaces with the first feature, the second feature, and the third feature.

The patterning of the first lithographic technique provides lines and spaces in a the first layer with a first pitch yielding a first  $k_1$  factor smaller than or equal to 0.5.

The first feature, the second feature, and the third feature are noncontiguous. The second pitch is two or more times larger than the first pitch. The continuity of at least the first collection, the second collection, and the third collection is broken in the transferred superposition.

The rejection of claim 22 contends that it would have been obvious for one of ordinary skill to have combined Okamoto, Nakao, and Sugita to arrive at the recited subject matter.

Applicant respectfully disagrees. In this regard, as discussed above, Okamoto's intended purpose is making a diffraction grating having a desired period and size in a desired location. Since claim 22 recites that continuity of collections of repeating lines and spaces provided in a first layer is broken in a superposition transferred to a substrate, claim 22 is inherently incompatible with Okamoto's intended purpose of making diffraction gratings. Accordingly, the subject matter recited in claim 22 would not have been obvious to those of ordinary skill.

Moreover, even if Okamoto's intended purpose were ignored and Okamoto were combined with Nakao and Sugita, one of ordinary skill would still not arrive at the subject matter recited in claim 22. For example, nothing in Nakao or Sugita would lead one of ordinary skill to break the continuity of collections of repeating lines and spaces provided in a first layer using bridging features in a photoresist layer, as recited in claim 22.

In this regard, as discussed above, Nakao uses two masks to avoid excessive exposures associated with "relatively large" bright line patterns. This is not understood to be relevant to the recited formation of noncontiguous features that bridge one or more of the repeating lines and spaces at different

longitudinal positions. Moreover, none of Nakao's bright lines bridge one another. Instead, the lines in the Nakao's successive patterns never cross. It would appear lines which never cross would be unsuitable for breaking continuity, as recited in claim 22.

Sugita does nothing to remedy these deficiencies in Nakao and Okamoto. In this regard, Sugita describes a system that uses "multiplex exposure amounts" to produce a pattern. See, e.g., *Sugita*, para. [0106]. According to Sugita, multiplex exposure amounts are achieved when three or more exposure levels (including zero level exposures) are used in a single layer of photoresist. This contrasts with the two exposure levels of a binary exposure levels system. *Id.*, para. [0032]. FIGS. 8A, 8B, 9A, 9B of Sugita illustrate Sugita's use of multiple exposure levels. In particular, the exposure levels denoted "0" and "1" are below the threshold exposure level " $E_{th}$ " whereas the exposure levels denoted "2" and "3" are above the threshold exposure level " $E_{th}$ ." Sugita thus relies upon the accumulation of successive dosages in a single layer of photoresist to define regions that are above the threshold exposure level " $E_{th}$ ."

Applicant respectfully submits that such an accumulation of different dosage levels in a single layer of photoresist would not lead one of ordinary skill to modify Okamoto and Nakao to

break the continuity of collections of repeating lines and spaces provided in a first layer using bridging features in a photoresist layer. Instead, Sugita confines his multiplex exposures to a single layer.

Thus, even if Okamoto, Nakao, and Sugita were combined, one of ordinary skill would not arrive at the recited subject matter. Claim 22 is not obvious on this basis as well.

Accordingly, applicant respectfully requests that the rejections of claims 22 and the claims dependent therefrom be withdrawn.

Claim 37 was rejected under 35 U.S.C. § 103(a) as obvious over Okamoto, Nakao, and Sugita.

Claim 37 relates to a method that includes patterning a first layer of photoresist on a substrate using interference lithography to provide a collection of periodic lines and spaces having a first pitch, patterning a second layer of photoresist using a second lithographic technique to provide an arbitrary feature with a second pitch, and etching the substrate to transfer a superposition of the lines and spaces provided by patterning the first layer and the arbitrary feature provided by patterning the second layer to the substrate. The second pitch is two or more times larger than the first pitch. The arbitrary figure comprises a first feature and a second feature that are

noncontiguous and that each bridge one or more of the repeating lines and spaces at different longitudinal positions. The continuity of at least one of the lines and spaces is broken at the different longitudinal positions in the transferred superposition.

The rejection of claim 37 contends that it would have been obvious for one of ordinary skill to have combined Okamoto, Nakao, and Sugita to arrive at the recited subject matter.

Applicant respectfully disagrees. In this regard, as discussed above, Okamoto's intended purpose is making a diffraction grating having a desired period and size in a desired location. Since claim 37 recites that the continuity of at least one of the lines and spaces in a collection of periodic lines and spaces is broken at the different longitudinal positions in a superposition transferred to a substrate, claim 37 is inherently incompatible with Okamoto's intended purpose of making diffraction gratings. Accordingly, the subject matter recited in claim 37 would not have been obvious to those of ordinary skill.

Moreover, even if Okamoto's intended purpose were ignored and Okamoto were combined with Nakao and Sugita, one of ordinary skill would still not arrive at the subject matter recited in claim 37. For example, nothing in Nakao or Sugita would lead

one of ordinary skill to break the continuity of at least one of the lines and spaces in a collection of periodic lines and spaces provided in a first layer of photoresist using an arbitrary feature provided in a second layer of photoresist, as recited in claim 37.

In this regard, as discussed above, Nakao uses two masks to avoid excessive exposures associated with "relatively large" bright line patterns. This is not understood to be relevant to the recited formation of noncontiguous features that bridge one or more of repeating lines and spaces at different longitudinal positions.

Moreover, none of Nakao's bright lines bridge one another. Instead, the lines in the Nakao's successive patterns never cross. It would appear lines which never cross would be unsuitable for breaking continuity, as recited in claim 37.

Sugita does nothing to remedy these deficiencies in Nakao and Okamoto. In this regard, as discussed above, Sugita relies upon the accumulation of successive dosages in a single layer of photoresist to define regions that are above the threshold exposure level "Eth." Such an accumulation of different dosage levels in a single layer of photoresist would not lead one of ordinary skill to break the continuity of at least one of the lines and spaces in a collection of periodic lines and spaces

provided in a first layer of photoresist using an arbitrary feature provided in a second layer of photoresist. Instead, Sugita confines his multiplex exposures to a single layer.

Thus, even if Okamoto, Nakao, and Sugita were combined, one of ordinary skill would not arrive at the recited subject matter. Claim 37 is not obvious on this basis as well.

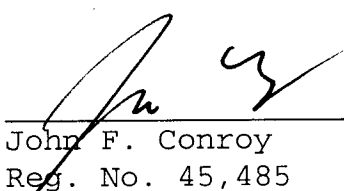
Accordingly, applicant respectfully requests that the rejections of claims 37 and the claims dependent therefrom be withdrawn.

It is believed that all of the pending claims have been addressed. However, the absence of a reply to a specific rejection, issue or comment does not signify agreement with or concession of that rejection, issue or comment. In addition, because the arguments made above may not be exhaustive, there may be reasons for patentability of any or all pending claims (or other claims) that have not been expressed. Finally, nothing in this paper should be construed as an intent to concede any issue with regard to any claim, except as specifically stated in this paper, and the amendment of any claim does not necessarily signify concession of unpatentability of the claim prior to its amendment.

Applicant asks that all claims be allowed. No fees are believed due at this time. Please apply any charges or credits, to Deposit Account No. 06-1050.

Respectfully submitted,

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